DOCUMENT RESUME

ED 328 226 IR 014 824

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TITLE How Teachers Improve Their Practices through Action Research: The Case of the Logo Action Research Collaborative.
PUB DATE Jul 90
NOTE 11p.; Paper presented at the World Conference on Computers in Education (Sydney, Australia, July 9-13, 1990).
PUB TYPE Reports - Descriptive (141) -- Speeches/Conference Papers (150)

EDRS PRICE MF01/PC01 Plus Postage.
DESCRIPTORS *Action Research; *Computer Assisted Instruction; Elementary Education; Inservice Teacher Education; Microcomputers; Participant Observation; Postsecondary Education; *Professional Development; Programing Languages; Teacher Improvement; *Teacher Workshops
IDENTIFIERS *LOGO Programing Language

ABSTRACT

The Logo Action Research Collaborative is creating a professional development program in the Newton (Massachusetts) schools which is based on action research and designed to support teachers and improve the use of Logo computer-assisted instruction in their classrooms. During the 1 year workshop, teachers work collaboratively on Logo programming projects, learn to define research questions, and identify ways to gather data that fit in with their teaching approaches. Teachers keep journals in which they write down classroom observations, and these are analyzed together with samples of student work. Through direct involvement in research teachers gain insights about the teaching and learning in their own classrooms, and, at the same time, come to recognize and respect their own and their colleagues' ideas. In addition to developing a set of materials and activities to support experienced Logo teachers in carrying out action research activities with a focus on Logo learning, the Logo Action Research Collaborative is supporting school district personnel in leading research meetings with teachers in their own districts. (27 references) (DB)

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HOW TEACHERS IMPROVE THEIR PRACTICES THROUGH ACTION RESEARCH: The Case of the LOGO Action Research Collaborative

by

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and
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The World Conference on Computers in Education
Sydney, Australia
July 1990

IR014824

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How Teachers Improve Their Practices Through Action Research: The Case of The Logo Action Research Collaborative

The World Conference on Computers in Education, Sydney, Australia, July, 1990

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The idea for the Logo Action Research Collaborative began with questions from teachers. In our lectures, classroom visits, and Logo workshops, teachers would frequently ask: "Is there any research I can cite to convince my school board (principal, superintendent, math supervisor, parents, ...) that Logo is valuable for students? I'm convinced that my students are learning important things, but I can't convince the school board." Our usual response is to turn the question around: "What are your Logo students learning, and how do you know?" Despite strong convictions about Logo's worth, based on watching their students work and seeing students' pride in their accomplishments, teachers answers were apt to be vague. This is one reason we sought support from the National Science Foundation to establish the Logo Action Research Collaborative.

A second justification came from the inconclusive results of academic research about Logo's effects on student learning. A variety of studies have attempted to measure what students gain from Learning Logo, with mixed results. Such studies rarely include descriptions of what students actually do in their Logo activities, or document students' learning based on what they accomplish in the classroom.

Finally, national studies of teacher professionalism such as the Carnegie Report and Holmes Report have strongly advocated expanded professional roles for teachers as a key aspect of school improvement. We are convinced that research by teachers is an effective avenue for professional growth, and this project is an effort to provide a supportive setting for such growth.

The Logo Action Research Collaborative is creating a professional development model based on action research, supported by a series

of collaborative research meetings conducted throughout a school year. "Action Research" is research carried out by classroom teachers for the purpose of assessing and improving teaching and learning in their own classrooms, and sharing what they have learned with other educators. We are developing a set of materials and activities to support experienced Logo teachers in carrying out action research activities with a focus on Logo Learning; and we are supporting school district personnel in leading research meetings with teachers in their own districts.

This project focuses on the Logo computer language. It is partially derived from a previous NSF-supported classroom research project, Exploratory Research on Critical Aspects of Logo Learning: A Collaborative Project with Teachers as Observers. We define "critical aspects of Logo learning," as knowledge, skills and understandings in computer science, mathematics and problem-solving, which are essential for effective learning of Logo, and are typically not discovered by students in isolation. Learning them often requires timely intervention by teachers and supportive classroom structures.

Our model for supporting action research involves a one-year cycle of fourteen after-school meetings with three overlapping phases. The first phase -- roughly four sessions -- is devoted to developing a common way of seeing and speaking. We do this by working collaboratively on Logo programming projects as a group of adults, and reflecting on the knowledge we have used. We also studying examples of student work to identify the knowledge they have and have not used. During this phase we draw on our shared experiences as Logo teachers to identify what each of us means by critical aspects of Logo. We also begin to assess whether students are using those aspects of Logo, and to identify appropriate next steps for particular students.

During the second phase, teachers define and refine their own research questions and identify ways to gather data that fit in with their teaching approaches. Then they begin to gather data and attempt to make sense of it through preliminary data analyses. Although the overall guiding question of the Logo Action Research Collaborative might be stated as "What are my Logo students learning, and how can I support them to learn as much as they can from their Logo experiences?" participating teachers have investigated a range of questions which arise out of their own

specific teaching objectives and circumstances: "How can I support my students to use procedures and subprocedures more effectively?" "How can I teach my fourth grade students to use variables and recursion?" "How can I help my students collaborate more effectively when they work together on Logo projects?" "Since I have to assign grades for Logo projects, can I set grading criteria that evolve throughout the year, and involve my students in assessing their own ongoing work?" "What do students who use Logo on the Macintosh accomplish that is different from students who use Logo on Apple II computers?"

During this phase of the research process, participants examine each others' data describing what they see; look for patterns in the data, help to clarify each other's research focus, and deal with issues generated by the process of the research itself. The third phase of the cycle is devoted to a more thorough analysis of the data each teacher has gathered over the course of the year. Part of our meeting time is spent supporting participants in identifying findings in their data and in writing reports about what they have learned.

Our uitimate goal is to develop a process that can be carried on by a group of teachers with local leadership. Our work will result in a one-week orientation and planning institute for leaders; a handbook and and guidelines for leaders; a Logo assessment guidebook for teacher/researchers; a monograph of teachers' research reports on Logo Learning; and an assessment of the project that will support its replication in other settings. We are particularly interested in collaborating with other educators to apply the methods we have developed to content areas other than Logo.

During the 1989-90 school year we have worked with a group of teacher researchers (representing grades 4 - 8) from Boston, Brookline and Concord Massachusetts. Next year the project will expand to involve nine different school districts. Groups of teacher researchers in Boston, Brookline and Concord, Massachusetts will be led by past project participants. Six additional groups will be led by experienced Logo teachers and teacher educators in Belleview, Washington; Brattleboro, Vermont; Chapel Hill, North Carolina; Chicago, Illinois; Ladue, Missouri; and Madison, Wisconsin. Group leaders from all nine districts will attend a one-week leadership institute at Education Development Center in Newton, Massachusetts.

Principles of Professional Development that support changes in practice.

In designing our research support model, we have made use of some principles and guidelines from twenty years of research on teacher development which are known to lead to improved teaching practices and changes in the classroom.

We agree with current views that teachers themselves are the key to school reform and to meaningful educational change; and that professional teachers who engage in reflective practices can develop the insights and expertise needed to make such changes. Teachers who choose to participate in the Logo Action Research Collaborative make a one-year commitment. Their principals and district administrators make a corresponding commitment to support the process actively, and to acknowledge their teachers' participation.

We believe that teachers teach as they are taught. Therefore we model the type of pedagogy and support structures that we would like to see teachers use with their students. However, we have no specific agenda for changing classroom practices. Teachers are free to decide how and what to investigate. They determine how to use what they learn from their own and their colleagues' action research, adapting it to their own circumstances, curricula, styles of teaching, students' needs and their expanding ideas about how students learn Logo.

Collegial support can provide a key impetus for classroom change. We have therefore created a collaborative structure within which teachers can support each other. Food plays an important role at each of our after-school research meetings. It nourishes participants after a day's work, and provides an informal opportunity for professional conversations. While eating together, people talk over issues and ideas, develop collegial relationships, and catch up on each other's work.

More formal reflective practices include making regular observations of two students throughout the year, in addition to investigating specific research questions. In research group meetings, participants share observations and examples of student work, get specific feedback from each other about their research questions and the data they have gathered, and discuss any

discoveries and difficulties encountered in the course of the research process. As a topic is discussed, we post handwritten notes on the walls. Some participants keep journals, make regular written observations, or keep anecdotal records.

Teachers can often develop better practices by having a respected, possibly more experienced, colleague take a genuine interest in their work. In our project, the group leaders may take on this role through regular conversations and occasional classroom visits with participants.

Recent national reports in the United States advocate expanded roles for teachers to increase teacher professionalism and improve education. The role of classroom researcher is one such role. Teacher researchers know that their work has the potential to contribute to professional knowledge about an educational problem or issue which is much larger than their own individual classrooms. Their research findings allow them to contribute to the knowledge base of the profession in a new and authoritative way.

Outcomes we have observed and documented

Through direct involvement in research -- formulating questions, observing, documenting, gathering a variety of data and making sense of it -- teachers gain insights about the teaching and learning in their own classrooms. At the same time, they come to recognize and respect their own and their colleagues' ideas, experience and expertise. Furthermore, from ideas shared by colleagues and/or modelled by the leaders, they acquire a greater variety of pedagogical strategies.

As teachers gain knowledge about individual students they develop a wider repertoire of specific ways to support the learning of particular students. They become more aware of different learning styles and cultural backgrounds. In the process, they discover that learning is not necessarily linear. It is frequently messier than they had expected. Thus, they develop a greater appreciation for the types of strategies needed to support open-ended problem solving and project development:

- During his first year as a Logo researcher, David Crump followed two fourth grade students whose Logo work puzzled him. Kathy was a tentative learner who did not seem to be making

progress or to benefit from his instruction. Jerry was an extremely quick learner, but was resistant to help from a teacher, preferring to use only his own ideas, even when he was stuck. David felt that both students were missing important learning opportunities. He brought examples of both students' work to the research group, and asked for feedback about the issues that were puzzling him. After a session in which we looked at one of Kathy's programs in great detail identifying the Logo knowledge she was and was not using, David was able to tailor some direct interventions that helped Kathy make what seemed to be remarkable process during the next few months. After a similar session focussing on Jerry's work, David was able to provide some input to Jerry indirectly by giving ideas to a classmate within earshot, or leaving a resource book open to a particular page. The research meetings gave David a way to reflect on his work with a group of colleagues and to find new strategies for supporting his students.

The group's common focus on Logo provides opportunities for participants to deepen their content knowledge as well:

- Donna Rosenberg came to understand that recursive procedure calls -- in which a procedure calls a copy of itself as a subprocedure -- is a fundamentally different concept than simple looping, and needed a different type of metaphor to make this distinction clear to students.

- While working with Kathy and other students who were having difficulties solving problems geometrically, David Crump came to a deeper understanding of the importance of the "Rule of 360" or the "Total Turtle Trip" -- the fact that a series of turtle commands which bring the turtle back to its starting point always involves a total rotation which is an exact multiple of 360 degrees.

Improved classroom curriculum is another outcome we have observed in several cases:

- Bob Kondel investigated the processes by which sixth grade students learn to use variables. His original intention was to introduce the use of variables to his most mathematically able students. As a result of his research, he realized that all his

sixth grade students were capable of using variables, if they were given appropriate challenges to support their learning.

• Donna Rosenberg wanted her students to learn to use variables and recursion, but she was unsure about whether they could understand the concepts involved. She kept detailed anecdotal notes about her own teaching of one fourth grade class. She recorded her teaching interventions, what she said, her students' comments and questions, and the Logo examples they produced over a period of a few months. as she taught one fourth grade class. She plans to use these notes to develop a curriculum to teach all her fourth and fifth grade students to use variables and recursion.

• Jim MacNeil used the occasion of introducing Macintosh Logo to study the differences between what students accomplished using Logo on the Mac and on the Apple II, and to develop and revise a packet of curriculum materials for Macintosh Logo.

We have observed that teachers who participate in the process of researching their own practice, not only become more flexible, more effective teachers. They also become more authoritative, articulate spokespersons about what their students are learning, and more able to justify the choices they make as Logo teachers. We also notice that some experienced teachers enter the project thinking they know everything they need to know to teach Logo effectively. After a year as classroom researchers the same teachers know that they have a lot more to learn about teaching and learning with Logo. And they have a number of strategies to continue learning, and collegial support to help them do so.

We would like to acknowledge the support we have received for this work from the National Science Foundation and Education Development Center, under NSF grants MDR 8651600 and TPE 8855541. We also want to acknowledge the contributions of our collaborative researchers: Gerri Abrams, Lorita Brockington, David Crump, Robert Kondel, Peter Lavelle, James MacNeil, Judith Randolph, Donna Rosenberg and Patricia Rowe. The views expressed in this paper, however, are strictly those of the authors and do not necessarily reflect the views of the National Science Foundation, Education Development Center or any of our collaborators.

Publications of the Logo Action Research Collaborative

Several of these papers are being compiled and edited into a monograph which will be published by the International Society for Technology in Education in the fall of 1990. A

monograph of reports by teachers is also being edited for publication as a working document in the fall of 1990.

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